

Application No. 10/653,032

Filing Date 08-28-2003

Amendments to the Claims

The following listing of claims replaces all prior versions, and listings, of claims in this application.

Listing of Claims

1. (Currently amended) Apparatus for treating a liquid sample stream, including at least one analyte ion species and matrix ion species of opposite charge to said one analyte ion species, and for detecting said at least one analyte in the sample stream, said apparatus comprising

a housing defining a flow-through treatment channel bounded by a liquid sample stream wall opposed from a spaced, substantially parallel carrier liquid stream wall, said treatment channel including an inlet and an first and second outlets,

a liquid sample stream, having at least one analyte ion species and matrix ion species of opposite charge to said at least one analyte ion species, in fluid communication with said treatment channel inlet and with said first outlet,

a carrier liquid stream including a matrix ion species capture material, comprising an ion exchange material or a material which forms a salt or complex with said matrix ion species, in fluid communication with said treatment channel inlet and with said second outlet for removing said matrix ion species away from said at least one analyte ion species.,

said liquid sample stream and carrier liquid stream being disposed in said treatment channel in substantially parallel flowing streams extending between the treatment channel inlet and outlet forming a liquid interface between said substantially parallel streams, said liquid sample stream flowing through said housing in contact with said liquid sample stream wall but out of contact with said carrier liquid stream wall, and said carrier liquid stream flowing through said housing in contact with said carrier liquid stream wall but out of contact with said liquid sample stream wall, said matrix ion species being present in said flow-through treatment channel at a first concentration at said treatment channel inlet and being present at a substantially lower

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concentration in said sample stream at said treatment channel outlet than at said treatment channel inlet,

a detector for said at least one analyte ion species in said sample stream, and
a fluid conduit providing fluid communication between said treatment channel first
outlet, but not said treatment channel second outlet, and said detector, said sample stream
flowing through said first conduit.

2. (Canceled)

3. (Original) The apparatus of Claim 1 further comprising a chromatography separator in fluid communication with said treatment channel inlet.

4. (Canceled)

5. (Currently amended) The apparatus of Claim-4_1 in which said ion exchange material is in liquid form and said carrier liquid stream is an organic liquid solvent for said ion exchange material.

6. (Currently amended) The apparatus of Claim-4_1 in which said ion exchange material comprises solid ion exchange particles suspended in said carrier liquid stream.

7. (Original) The apparatus of Claim 1 in which said carrier liquid stream is substantially immiscible in said liquid sample stream.

8. (Original) The apparatus of Claim 1 in which said liquid sample stream is aqueous.

9. (Original) The apparatus of Claim 1 in which said carrier liquid stream is immiscible in said liquid sample stream.

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10. (Canceled)

11. (Canceled)

12. (Currently amended) A method for treating a liquid sample stream, including at least one analyte species ion and matrix ion species of opposite charge to said one analyte ion species, and for detecting said at least one analyte in the liquid sample stream, said method comprising flowing said sample stream from an inlet in a flow-through treatment channel to an outlet thereof, and-flowing a carrier liquid stream including a matrix ion species capture material through said flow-through channel for removing said matrix ion species away from said at least one analyte ion species, said sample stream and carrier liquid stream flowing substantially parallel to each other in said treatment channel and forming a liquid interface between them, said matrix ion species in said sample stream diffusing through said interface to contact and become bound by said capture material in said carrier liquid by forming a salt or complex or by ion exchange so that the concentration of said matrix ion species at said outlet is at a substantially lower concentration than at said inlet, detecting said one analyte ion species in said sample stream, and separating said sample stream and carrier liquid stream exiting from said treatment channel prior to said detecting.

13. (Original) The method of Claim 12 in which no substantial amount of said capture material in said carrier liquid stream flows into said sample stream in said treatment channel.

14. (Canceled)

15. (Canceled)

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16. (Currently amended) The method of Claim-15-12 in which said sample stream comprises at least a second analyte ion species, said method further comprising separating said one and second analyte ion species in said sample stream prior to flowing said sample stream to the treatment channel inlet.

17. (Canceled)

18. (Currently amended) The method of Claim-17-12 in which said liquid sample stream is aqueous, said ion exchange material is in liquid form, and said carrier liquid stream is an organic liquid solvent for said ion exchange material.

19. (Currently amended) The method of Claim-17-12 in which said ion exchange material comprises solid ion exchange particles suspended in said carrier liquid stream.

20. (Original) The method of Claim 12 in which said carrier liquid stream is substantially immiscible in said aqueous liquid stream.

21. (Original) The method of Claim 12 in which said carrier liquid stream is substantially miscible in said aqueous liquid stream.

22. (Original) The method of Claim 16 in which said matrix ion species is suppressed on exiting said treatment channel.

23. (Canceled)

24. (Canceled)

25. (Currently amended) The method of Claim 12 A method for treating a liquid sample stream including at least one analyte species ion and matrix ion species of opposite

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charge to said one analyte ion species, said method comprising flowing said sample stream from an inlet in a flow-through treatment channel to an outlet thereof, and flowing a carrier liquid stream including a matrix ion species capture material through said flow-through channel for removing said matrix ion species away from said at least one analyte ion species, said sample stream and carrier liquid stream flowing substantially parallel to each other in said treatment channel and forming a liquid interface between them, said matrix ion species in said sample stream diffusing through said interface to contact and become bound by said capture material in said carrier liquid so that the concentration of said matrix ion species at said outlet is at a substantially lower concentration than at said inlet, in which said capture material binds said matrix ion species by forming a salt or complex.

26. (Original) The method of Claim 12 in which said sample stream and carrier liquid stream flow under substantially laminar flow conditions.

27. (Canceled)

28. (Original) The method of Claim 12 performed in the absence of an applied electric current.